# SPG(M2)

## EoS Submission Details

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|---|---|
| EoS name | SPG(M2) |
| category | Inner crust |
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## Abstract

This crust EoS for $\beta$-equilibrium matter at zero temperature is constructed with a BSk22 outer crust [1] below $n_B = 2 \times 10^{-3}$ fm$^{-3}$ and inner crust EoS calculated within a Compressible Liquid Drop approach [2] up to $n_B = 0.89 \times 10^{-1}$ fm$^{-3}$. The EoS parameterisation used was one of the density-dependent RMF models with the GDFM functional for the couplings [3] generated in a Bayesian analysis and that agrees with both astrophysical and nuclear constraints [4].

## References to the original work

1. J. M. Pearson, N. Chamel, A. Y. Potekhin, A. F. Fantina, C. Ducoin, A. K. Dutta, and S. Goriely, MNRAS 481, 2994 (2018); https://compose.obspm.fr/eos/210 .

2. G. Baym, H. A. Bethe and C. J. Pethick, Nuclear Physics A **1**75, 225 (1971).

3. P. Gogelein, E. N. E. van Dalen, C. Fuchs and H. Muther, Phys. Rev. C **77**, 025802 (2008).

4. L. Scurto, H. Pais and F. Gulminelli in preparation

## Nuclear Matter Properties[1]

| | Quantity | Unit | |
|---|---|---|---|
| $n_S$ | saturation density in symmetric matter | $\mathrm{fm}^{-3}$ | 0.155 |
| $E_0$ | binding energy per baryon at saturation | MeV | -15.9 |
| $K$ | incompressibility | MeV | 224 |
| $K'$ | skewness | MeV | 230 |
| $J$ | symmetry energy | MeV | 30.2 |
| $L$ | symmetry energy slope parameter | MeV | 40 |
| $K_{sym}$ | symmetry incompressibility | MeV | -59.8 |

## Neutron Star Properties[1]

| | Quantity | Unit | |
|---|---|---|---|
| $M_{max}$ | maximum mass | $\mathrm{M_{sun}}$ | 2.42 |
| $M_{DU}$ | mass at DUrca threshold with $\mu^-$ | $\mathrm{M_{sun}}$ | 2.38 |
| $R_{M_{max}}$ | radius at maximum NS mass | km | 11.51 |
| $R_{1.4}$ | radius at 1.4 $\mathrm{M_{sun}}$ NS mass | km | 12.63 |
| $\tilde{\Lambda}$ | tidal deformability for GW170817 at a mass ratio of $q = 0.8$ | - | 907.48 |

## eos.thermo

eos.thermo and the three grid defining files are CompOSE standard data files and by definition available.

| | |
|---|---|
| table dimension | 1 |
| table type | 1 |
| total number of grid points | 377 |

Range and density (#) of the grid parameters:

| | Quantity | Unit | min | max | # |
|---|---|---|---|---|---|
| T | Temperature | MeV | 0 | 0 | 1 |
| $\mathrm{n}_b$ | Baryon Nr Density | $\mathrm{fm}^{-3}$ | $0.467962 \times 10^{-9}$ | $0.8912 \times 10^{-1}$ | 377 |
| $\mathrm{Y}_q$ | Charge Fraction | | 0 | 0 | 1 |

T, $\mathrm{n}_b$, and $\mathrm{Y}_q$ are stored in eos.t, eos.nb, and eos.yq, respectively.

[1] 0-values indicate that the corresponding data is not provided.

### Further Available Data Files

Files and quantities listed in the following are provided beyond CompOSE's core requirements as outlined in Sec.4.2. of the CompOSE manual.

**eos.mr** : This file provides the radius (in km), the gravitational mass (in solar masses), the adimensional tidal deformability and the central density (in $fm^{-3}$) of a family of stars computed for this unified inner-crust–core RMF EoS model, with the BSk22 outer crust.

**eos.compo** : available
4 particle pairs (neutrons, protons, electrons, muons) and one quadruple for heavy nucleus.
Phase index # 0: outer crust
Phase index # 7: inner crust

**eos.micro** : not available